Bacterial Respiratory Infections in the Department of Defense (DOD): Fiscal Years (FY) 2013 – 2015

NMCPHC-EDC-TR-664-2016

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EpiData Center Department
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14. ABSTRACT Respiratory illness is a constant threat for military personnel due to crowded and stressful occupational condition.1 Respiratory infections are among the leading causes of medical encounters, in both the ambulatory and hospital setting, among active duty service members and one of the leading causes of ambulatory clinic visits and absenteeism from work or school in the United States (US).2,3 This analysis utilized Health Level 7 formatted (HL7) Composite Health Care System (CHCS) microbiology and chemistry data to describe bacterial respiratory infections from 01 October 2012 to 30 September 2015 among all Department of Defense (DOD) beneficiaries seeking care within the Military Health System (MHS). Monthly cases of upper respiratory infections (URIs) in the surveillance period were higher than the frequency of URIs observed prior to 2012. Frequency of URI cases did not align with expected seasonal variations during FYs 2014 and 2015. Lower respiratory infections (LRIs) during the surveillance period were also higher than the frequency of LRIs observed in prior time periods and did not align with expected seasonal variations of higher winter and lower summer frequencies. Among URIs and LRIs, for FY 2014 and FY 2015, the volume of cases identified in the winter months were 1.3 – 1.5 times higher compared to the volume identified in FY 2013. Overall, the frequency of URIs and LRIs increased (38.6% and 15.2%, respectively) from FY 2013 to FY 2015. Streptococcus				
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Abstract

Respiratory illness is a constant threat for military personnel due to crowded and stressful occupational condition.[1] Respiratory infections are among the leading causes of medical encounters, in both the ambulatory and hospital setting, among active duty service members and one of the leading causes of ambulatory clinic visits and absenteeism from work or school in the United States (US).[2,3] This analysis utilized Health Level 7 formatted (HL7) Composite Health Care System (CHCS) microbiology and chemistry data to describe bacterial respiratory infections from 01 October 2012 to 30 September 2015 among all Department of Defense (DOD) beneficiaries seeking care within the Military Health System (MHS). Monthly cases of upper respiratory infections (URIs) in the surveillance period were higher than the frequency of URIs observed prior to 2012. Frequency of URI cases did not align with expected seasonal variations during FYs 2014 and 2015. Lower respiratory infections (LRIs) during the surveillance period were also higher than the frequency of LRIs observed in prior periods and did not align with expected seasonal variations of higher winter and lower summer frequencies. Among URIs and LRIs, for FY 2014 and FY 2015, the number of cases identified in the winter months were 1.3 – 1.5 times higher compared to the number identified in FY 2013. Overall, the frequency of URIs and LRIs increased (38.6% and 15.2%, respectively) from FY 2013 to FY 2015. *Streptococcus* species were the most commonly isolated organisms among URIs, while *Staphylococcus* species were most common among LRIs from FY 2013 to FY 2015. Beneficiaries aged 5 – 17 experienced the highest rates of URIs; however, older beneficiaries (65 and older) had the highest rates of LRIs. Continued periodic monitoring of bacterial respiratory infections is warranted to track infection trends, identify populations at risk, and aid in the development of clinical guidelines and policies.

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Executive Summary

The EpiData Center Department (EDC) at the Navy and Marine Corps Public Health Center (NMCPHC) conducts routine surveillance of clinically significant outcomes within the Department of the Navy (DON), as well as the Department of Defense (DOD). This report provides a summary of bacterial upper respiratory infections (URI) and lower respiratory infections (LRI) from October 2012 through September 2015 among DOD beneficiaries. It also describes the demographic and clinical characteristics.

This analysis utilized Health Level 7 (HL7) formatted Composite Health Care System (CHCS) microbiology and chemistry data to identify URIs and LRIs. Seasonal trend comparisons were made by fiscal year (FY) and defined as October 01 through September 30. Calculated rates provided comparison across the years.

The overall frequency and rate of LRIs and URIs due to *Streptococcus* species increased from FY 2013 to FY 2015, with a statistically significant increase among *Streptococcus* URIs during the surveillance period. The frequency and rate of URIs due to the other organisms of interest (*Haemophilus*, *Klebsiella*, *Pseudomonas*, and *Staphylococcus* species) decreased from FY 2013 to FY 2015, with statistically significant changes for all organisms except *Klebsiella*.

This report assessed recent trends in URIs and LRIs in the United States (US) DOD beneficiary population. Periodic monitoring of both URIs and LRIs is important given the occupational exposures of DOD personnel, such as frequent deployments, relocations, and travel. Surveillance of bacterial respiratory infections contributes to risk reduction by tracking trends and identifying populations at risk, which may mitigate increased morbidity and mortality.

Introduction

Acute respiratory infections are one of the leading causes for patients to visit a physician, as well as a reason for absenteeism from work or school.[1] Many of the organisms associated with respiratory infections display seasonal variability, with the frequency increasing during the winter months, which coincides with more time spent indoors and exposure to overcrowding. The majority of these infections are viral, but bacterial infections, particularly coinfections with a respiratory viral infection, can cause increased morbidity and mortality. Viruses can cause damage to the airway, increasing binding sites, and improving conditions for invasion of bacteria.[4] Studies of viral respiratory infections have reported URIs and LRIs as complications of infection, thereby prolonging disease and contributing to more severe clinical symptoms.[5-8]

URIs are illness caused by an acute infection which involves the upper respiratory tract, including the nose, sinuses, pharynx, or larynx. This commonly includes tonsillitis, pharyngitis, laryngitis, sinusitis, otitis media, and the common cold. Common organisms isolated during an URI are *Streptococcus pneumoniae*, *Staphylococcus aureus*, and *Haemophilus influenza*. URIs in young children are often complicated by otitis media as children are far more susceptible to otitis media due to developing immune systems and the length and position of the Eustachian tubes.[9]

LRIs include bronchitis and pneumonia. *S. pneumoniae* is the organism most often associated with community-acquired bacterial pneumonia.[10] *Klebsiella pneumoniae* infections are more common among older individuals and those with weakened immune systems. During the 2011 – 2012 influenza season, *S. aureus*, particularly methicillin-resistant *S. aureus* (MRSA), gained attention with a cluster of deaths occurring among several family members found to be coinfected with influenza.[11]

Both URI and LRI within the US military population can negatively affect force health protection and mission readiness. Specific military populations, such as recruits or those assigned to shipboard duty, are at increased risk for both URI and LRI as a result of close quarters imposed on a daily basis. The DOD prescribes several policies and programs for respiratory infection surveillance among vulnerable and high-risk populations. These efforts include the Naval Health Research Center's (NHRC) febrile respiratory illness (FRI) program and service-level streptococcus/acute respiratory disease (ARD) policies that are employed in the basic training centers. However, these initiatives do not address any epidemiologic understanding of burden of illness across the overall DOD population. The literature is limited on the burden of bacterial URIs and LRIs in the overall DOD beneficiary population.

This report describes bacterial respiratory infections among DOD beneficiaries seeking care in the Military Health System (MHS) by FY from October 2012 through September 2015. This report updates a prior report of bacterial respiratory infections among DOD beneficiaries for FY 2008 to 2012.[12]

Methods

This surveillance report provides a retrospective analysis from October 1, 2012 through September 30, 2015 assessing the burden and trends of bacterial respiratory infections, both URI and LRI, among DOD beneficiaries. Due to seasonality of influenza and bacterial infections, data were analyzed by FY (01 October – 30 September).

Microbiology and chemistry HL7 formatted data that originates from the CHCS at fixed military treatment facilities (MTFs), hereafter referred to as HL7 data, were used for identification of bacterial respiratory infections. These data do not include records from purchased care providers, shipboard facilities, battalion aid stations, or in-theater facilities. Analysis limited HL7 chemistry data to records with rapid diagnostic testing for *Streptococcus* species based upon recommended diagnostic criteria in clinical practice guidelines.[13] HL7 microbiology data were not limited by testing method and analysis included all records with an organism of clinical significance identified. This report includes the five most clinically significant and prevalent species: *Haemophilus*, *Klebsiella*, *Pseudomonas*, *Staphylococcus*, and *Streptococcus*. Surveillance cultures, defined as specimens isolated from nares and nasal cavity specimens, were excluded as these surveillance cultures are typically indicative of colonization and not true infection. Records with nonspecific specimen sources, such as swab, were also excluded. URIs were defined as specimens isolated from above the larynx (e.g., pharynx, ear, sinus). LRIs included tracheal, sputum, or bronchial specimens (Table 1).[12]

Table 1. Infection Classification for Bacterial Respiratory Infections within the Department of Defense (DOD), FY 2013 – 2015

Infection Classification	If Body Site or Specimen Source Sample Taken From:
Upper Respiratory Infections (URIs)	Adenoid, back of nose, ear, ethmoid, external auditory canal, mouth, mucosa, mucous, mucus, nasal septum, nasopharyngeal, nasopharynx, nose, oral cavity, peritonsillar, pharynx, sinus, throat, tongue, tonsil, tymphanic membrane, upper respiratory tract
Lower Respiratory Infections (LRIs)	Bronchial, bronchial lavage, bronchial washing, bal, endotracheal, lung, sputum, trachea, tracheal aspirate, pleura, pleural

Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, on 26 February 2016.

A 14-day gap in care rule was used to identify cases. Unique organisms were counted once within a 14-day period. All unique organisms within a rolling 14-day period contributed to the case totals, though the first record per case was used to describe patient type and classify specimens. Although clinical guidelines do not recommend antibiotics for most URIs, the 14-day timeframe was considered adequate given treatment duration generally prescribed for the limited cases in which antibiotics are considered effective.[14-17]

Patient demographic and clinical characteristics for both URIs and LRIs were identified from the first record per person per FY to avoid overestimation due to comorbidities. Clinical characteristics were described by case. Variables contained in the laboratory record denoted demographic and clinical characteristics such as age, gender, beneficiary status (active duty/recruit, retired, family member, or other), and patient type (inpatient or outpatient). Recruit beneficiaries are grouped with active duty beneficiaries. The TRICARE region (North, South, West which includes Alaska, outside the Continental United States (OCONUS), and unspecified) was defined as the region of the servicing MTF and identified by the requesting facility's unique identification number.

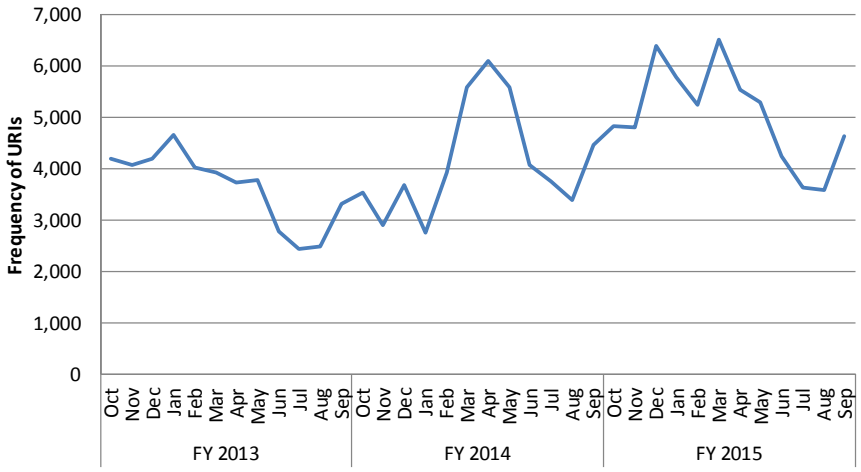
Calculated rates facilitated comparisons between years. Infection rates were calculated per 1,000 tests performed per specimen in the microbiology and chemistry HL7 data; however, chemistry data was restricted to only records for rapid diagnostic testing for *Streptococcus* species. The demographic rates of infection were calculated per 1,000 eligible DOD beneficiaries identified in the Military Health System (MHS) Data Mart (M2). The Cochran-Armitage trend test was used to assess trends across the years with significance set at P value $\leq .05$. The percent change in rate from FY 2013 to FY 2015 was calculated to describe the change in infection rate from the beginning to the end of the surveillance period. SAS 9.4 software (SAS Institute, Cary, North Carolina, US) facilitated data analysis.

Results

Upper Respiratory Infections

DOD beneficiaries had a monthly average of 4,250 bacterial URIs from October 2012 through September 2015. Across the surveillance period, URIs peaked each year in January 2013, April 2014, and March 2015 (N = 4,653; 6,092; 6,508; respectively). The lowest frequencies most often occurred during the summer months (June through August), except for FY 2014 in which January had the lowest monthly frequency. Additionally, for FY 2014 and FY 2015, the number of cases reported in the winter months was 1.5 times higher compared to the number reported in FY 2013. FY 2014 experienced the greatest increase in URIs during the surveillance period; from the beginning of FY 2014 (October 2013) to the end of FY 2014 (September 2014), there was a 26.6% increase in URIs. Overall, from FY 2013 (N = 43,654) to FY 2015 (N = 60,491) the frequency of URIs increased by 38.6% (Figure 1).

Figure 1. Frequency of Upper Respiratory Bacterial Infections[a] among DOD Beneficiaries, FY 2013 – 2015



[a] Organisms included in this analysis were from *Haemophilus*, *Klebsiella*, *Pseudomonas*, *Staphylococcus*, and *Streptococcus* species.
Data Source: NMCPHC HL7 formatted CHCS chemistry and microbiology databases.
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center, on 24 June 2016.

The top two organism groups identified as URIs were *Streptococcus* and *Staphylococcus spp*. (Table 2). On average in each FY, *Streptococcus* species accounted for 96% of all URIs identified, with Group A *Streptococcus* (GAS) accounting for more than 55% of *Streptococcus* species infections. *Staphylococcus* species infections accounted for 3% of all URIs identified on average, with *S. aureus* the most commonly identified (80%). *Haemophilus*, *Klebsiella*, and *Pseudomonas* each accounted for less than 1% of all URIs identified each year. Rates decreased from the first fiscal year to the last fiscal year for all selected organisms except *Streptococcus*, which experienced a 7.6% increase from FY 2013 to FY 2015.

Table 2. Distribution of Organisms Identified from Upper Respiratory Infections with Rates of Infections per 1,000 Tests Performed among DOD Beneficiaries, FY 2013 – 2015

Upper Respiratory Infections	FY 2013				FY 2014				FY 2015				Percent Change[a]	*P* Value[b]
	n	Rate	CI Lower	CI Upper	n	Rate	CI Lower	CI Upper	n	Rate	CI Lower	CI Upper		
Haemophilus	296	1.4	1.2	1.5	262	1.2	1.0	1.3	274	1.0	0.8	1.1	-28.8	<.0001
Klebsiella	84	0.4	0.3	0.5	78	0.3	0.3	0.4	91	0.3	0.3	0.4	-16.6	0.11
Pseudomonas	360	1.6	1.5	1.8	397	1.7	1.6	1.9	382	1.3	1.2	1.5	-18.4	0.0002
Staphylococcus	1,128	5.2	4.9	5.5	1,145	5.0	4.7	5.3	1,286	4.5	4.3	4.8	-12.3	<.0001
Streptococcus	41,786	191.1	189.2	192.9	47,971	210.7	208.8	212.6	58,458	208.7	204.0	207.3	7.6	<.0001
Total	43,654	--	--	--	49,852	--	--	--	60,491	--	--	--	--	--

95% Confidence Intervals
[a] Rate percent change was calculated between FY 2013 and FY 2015.
Data Source: NMCPHC HL7 formatted CHCS chemistry and microbiology databases.
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center on 24 June 2016.

Table 3 presents the rates of bacterial URIs by demographic characteristic. Since FY 2013, individuals between 5 and 44 years of age were more impacted by URIs than the youngest (aged 0-4) and oldest (aged 65 and older) beneficiaries, with those aged 5-17 having the highest incidence rates each FY. Family members accounted for more than 60% of URIs, while active duty service members accounted for approximately 35% of infections and had the highest incidence rates each FY. The South TRICARE region identified the highest proportion of URIs (approximately 33% each year), although OCONUS had the highest rates.

All demographic categories experienced increases in URIs from FY 2013 to FY 2015. All age categories, except for those aged 18 – 24, experienced a greater than 45% increase in incidence rate from FY 2013 to FY 2015. Male and female beneficiaries experienced a similar incidence rate of URI each year; however, females had a higher percent increase (42.3%) in incident cases than their male counterparts (35.1%). Active duty service members had the highest incidence rates of URIs, while retired beneficiaries had the greatest percent increase (58.2%) from FY 2013 to 2015. All TRICARE regions increased in incident URIs; the OCONUS region had the highest incidence rates of URIs each year and had the largest percent increase, 67.6%, followed by the South region with an increase of 44.9% over the surveillance period (Table 3).

Table 3. Stratification of Upper Respiratory Infections among DOD Beneficiaries , FY 2013 – 2015[a]

	FY 2013				FY 2014				FY 2015				Percent
Age	**n**	**Rate**	**CI Lower**	**CI Upper**	**n**	**Rate**	**CI Lower**	**CI Upper**	**n**	**Rate**	**CI Lower**	**CI Upper**	**Change[c]**
0-4	3,159	5.31	5.13	5.50	3,947	6.76	6.55	6.97	4,520	7.98	6.55	8.22	50.3
5-17	13,575	9.88	9.71	10.04	15,616	11.49	11.31	11.67	19,271	14.39	11.31	14.59	45.6
18-24	10,512	8.75	8.59	8.92	10,790	9.17	9.00	9.34	12,440	10.88	9.00	11.08	24.3
25-44	12,262	6.13	6.02	6.23	14,360	7.24	7.12	7.35	17,415	8.88	7.12	9.01	45.0
45-64	1,784	0.85	0.81	0.89	2,016	0.98	0.93	1.02	2,681	1.32	0.93	1.37	55.6
>64	149	0.07	0.06	0.08	162	0.08	0.06	0.09	232	0.11	0.06	0.12	48.8
Gender													
Female	20,017	4.37	4.31	4.43	23,214	5.09	4.31	5.15	28,172	6.22	6.15	6.30	42.3
Male	21,424	4.51	4.45	4.57	23,677	5.02	4.45	5.09	28,389	6.09	6.02	6.16	35.1
Beneficiary Status													
Active Duty	14,305	10.19	10.03	10.36	15,129	10.96	10.78	11.13	17,645	13.23	13.04	13.43	29.8
Retired	726	0.35	0.32	0.37	849	0.41	0.38	0.43	1,170	0.55	0.52	0.58	58.2
Family Membe	24,787	5.01	4.94	5.07	29,181	5.91	5.85	5.98	35,654	7.30	7.22	7.37	45.8
Other	1,623	1.81	1.72	1.90	1,732	1.99	1.90	2.09	2,092	2.45	2.35	2.56	35.5
TRICARE Region													
North	12,566	4.23	4.15	4.30	11,858	4.00	3.93	4.08	16,291	5.56	5.47	5.64	31.4
South	13,538	4.61	4.54	4.69	16,355	5.59	5.50	5.67	19,456	6.69	6.59	6.78	44.9
West	11,837	4.26	4.18	4.33	13,859	5.01	4.93	5.10	15,186	5.56	5.47	5.65	30.7
OCONUS[b]	3,457	9.27	8.96	9.57	4,742	12.86	12.50	13.23	5,628	15.53	15.13	15.94	67.6
Unspecified	43	0.23	0.16	0.30	77	0.44	0.34	0.54	0	--	--	--	0.0
Total	41,441	--	--	--	46,891	--	--	--	56,561	--	--	--	--

[a] First record per individual per year.
[b] OCONUS = Outside the continental United States
[c] Rate percent change was calculated between the FY 2013 rate and the FY 2015 rate.
95% Confidence Intervals
Rate per 1,000 beneficiaries
Data Source: NMCPHC HL7 formatted CHCS chemistry and microbiology databases.
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center on 06 December 2016.

There were 153,997 URIs identified during the surveillance period among 144,893 individuals (Table 4). The throat was the most common specimen source each year (97%). The outpatient setting was the predominant location for patient encounters for URI specimen collection (99%).

Table 4. Total Upper Respiratory Infections by Select Clinical Characteristic among DOD Beneficiaries, FY 2013 – 2015

	Total	FY 2013	FY 2014	FY 2015
Specimen				
Ear	2,868	902	944	1,022
Nasal mucus	2	1	1	0
Nasopharyngeal	475	121	198	156
Oral	331	99	111	121
Sinus	412	111	158	143
Throat	149,878	42,411	48,428	59,039
Upper, NOS[a]	31	9	12	10
Patient Type				
Inpatient	431	127	144	160
Outpatient	153,566	43,527	49,708	60,331
Total	153,997	43,654	49,852	60,491

[a] NOS = Not otherwise specified

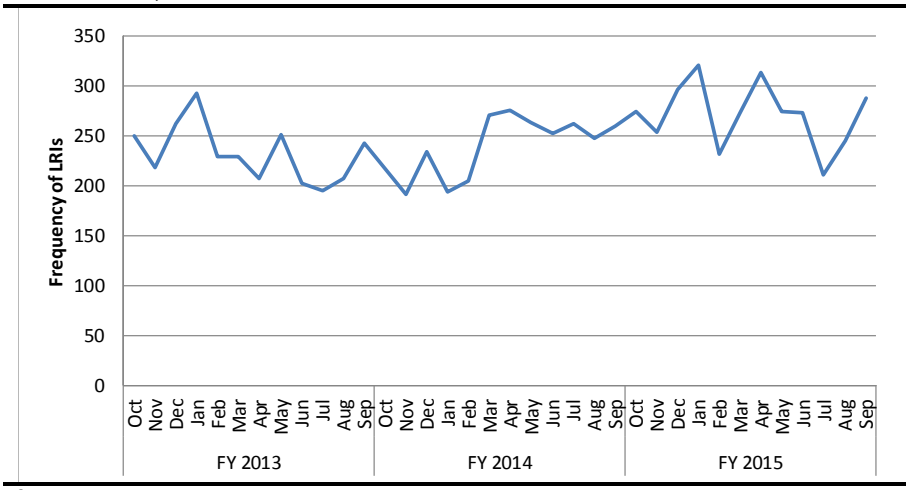
Data Source: NMCPHC HL7 formatted CHCS chemistry and microbiology databases.

Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center on 1 March 2016.

Lower Respiratory Infections

Over the surveillance period, DOD beneficiaries had an average of 242 bacterial LRIs each month. LRIs peaked in January 2013, April 2014, and January 2015 (N = 297; 276; 321; respectively). The lower peaks occurred during the summer months (July annually) in FY 2013 and 2015; however, in FY 2014, November had the lowest monthly frequency. LRI cases during the surveillance period do not align with expected seasonal variations of higher winter and lower summer frequencies. Additionally, for FY 2014 and FY 2015, the number of cases reported in the winter months were 1.3 times higher compared to the number reported in FY 2013. Overall, FY 2014 experienced the greatest increase in LRIs during the surveillance period; from the beginning of FY 2014 (October 2013) to the end of FY 2014 (September 2014), there was a 19.8% increase in LRIs. Overall, from FY 2013 (N = 250) to FY 2015 (N = 288) the frequency of LRIs increased by 15.2% (Figure 2).

Figure 2. Frequency of Lower Respiratory Bacterial Infections[a] among DOD Beneficiaries, FY 2013 – 2015



[a] Organisms included this analysis were from *Haemophilus*, *Klebsiella*, *Pseudomonas*, *Staphylococcus*, and *Streptococcus* species.
Data Source: NMCPHC HL7 formatted CHCS chemistry and microbiology database.
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center on 24 June 2016.

Staphylococcus and *Pseudomonas spp.* were identified most often in the lower respiratory system (Table 5). *Staphylococcus* species accounted for approximately 35% of all LRIs identified each FY, with identification of *S. aureus* in more than 90% of cases. *Pseudomonas* species infections accounted for 27% of LRIs. Of these, approximately 95% were identified as *Pseudomonas aeruginosa*. *Haemophilus*, *Klebsiella*, and *Streptococcus* infections comprised the remaining one-third of LRIs identified from FY 2013 – FY 2015. However, each species increased from FY 2013 to FY 2015. *Staphylococcus* species had the greatest percent increase at 29.8%, followed by *Pseudomonas* species at 23.1%.

Table 5. Distribution of Organisms Identified from Lower Respiratory Infections with Rates of Infections per 1,000 Tests Performed among DOD Beneficiaries, FY 2013 – 2015

Lower Respiratory Infections	FY 2013				FY 2014				FY 2015				Percent Change[a]
	n	Rate	CI Lower	CI Upper	n	Rate	CI Lower	CI Upper	n	Rate	CI Lower	CI Upper	
Haemophilus	374	24.0	20.8	26.4	329	22.7	19.5	25.2	410	27.8	24.4	30.5	15.9
Klebsiella	257	16.5	13.5	18.5	251	17.3	14.3	19.5	274	18.6	15.5	20.8	12.7
Pseudomonas	729	46.7	43.0	50.1	788	54.4	50.5	58.2	849	57.5	53.6	61.4	23.1
Staphylococcus	956	61.2	57.3	65.1	1,037	71.6	67.5	76.0	1,174	79.5	75.2	84.0	29.8
Streptococcus	476	30.5	27.1	33.2	472	32.6	29.1	35.6	551	37.3	33.8	40.4	22.4
Total	2,792	--	--	--	2,877	--	--	--	3,258	--	--	--	--

95% Confidence Intervals
[a] Rate percent change was calculated between FY 2013 and FY 2015.
Data Source: NMCPHC HL7 formatted CHCS chemistry and microbiology databases.
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center on 24 June 2016.

Table 6 presents the rates of bacterial LRIs by demographic characteristic. Each year since FY 2013, individuals older than 64 years had the highest incidence rates. Family members accounted for roughly 40% of LRIs, while retired beneficiaries accounted for less than 30% of infections. The rates of LRI in each TRICARE region were similar (0.2 – 0.3 per 1,000 DOD beneficiaries per region each FY); however, the West region comprised the highest proportion of cases (36%).

All demographic categories experienced increases in LRIs from FY 2013 to FY 2015, except for beneficiaries aged 18 – 24 and those in the OCONUS TRICARE region. Beneficiaries aged 5-17 and 45-64 had the highest percent increase in incidence rate from FY 2013 to FY 2015. Beneficiaries aged 18-24 had a nearly 10% decrease in incidence rate during the surveillance period. Male and female beneficiaries experienced a similar incidence rate of LRI each year; however, females had a higher percent increase (14.4%) than their male counterparts (7.8%). The South TRICARE region had the greatest percent increase in incidence rate (24%) among all demographic categories (Table 6).

Table 6. Stratification of Lower Respiratory Infections among DOD Beneficiaries, FY 2013 – 2015[a]

	FY 2013				FY 2014				FY 2015				Percent
Age	**n**	**Rate**	**CI Lower**	**CI Upper**	**n**	**Rate**	**CI Lower**	**CI Upper**	**n**	**Rate**	**CI Lower**	**CI Upper**	**Change[c]**
0-4	110	0.18	0.15	0.22	99	0.17	0.14	0.20	112	0.20	0.14	0.23	7.0
5-17	125	0.09	0.08	0.11	125	0.09	0.08	0.11	142	0.11	0.08	0.12	16.5
18-24	179	0.15	0.13	0.17	165	0.14	0.12	0.16	154	0.13	0.12	0.16	-9.6
25-44	270	0.13	0.12	0.15	297	0.15	0.13	0.17	266	0.14	0.13	0.15	0.6
45-64	465	0.22	0.20	0.24	460	0.22	0.20	0.24	532	0.26	0.20	0.28	18.5
>64	729	0.35	0.33	0.38	699	0.33	0.31	0.36	827	0.38	0.31	0.41	8.4
Gender													
Female	663	0.14	0.13	0.16	670	0.15	0.13	0.16	750	0.17	0.15	0.18	14.4
Male	1,219	0.26	0.24	0.27	1,179	0.25	0.24	0.26	1,289	0.28	0.26	0.29	7.8
Beneficiary Status													
Active Duty	216	0.15	0.13	0.17	217	0.16	0.14	0.18	224	0.17	0.15	0.19	9.1
Retired	511	0.25	0.22	0.27	494	0.24	0.22	0.26	577	0.27	0.25	0.29	10.8
Family Membe	755	0.15	0.14	0.16	764	0.15	0.14	0.17	841	0.17	0.16	0.18	12.9
Other	400	0.45	0.40	0.49	374	0.43	0.39	0.47	397	0.47	0.42	0.51	4.3
TRICARE Region													
North	526	0.18	0.16	0.19	530	0.18	0.16	0.19	529	0.18	0.17	0.20	1.9
South	553	0.19	0.17	0.20	539	0.18	0.17	0.20	680	0.23	0.22	0.25	24.0
West	696	0.25	0.23	0.27	672	0.24	0.22	0.26	729	0.27	0.25	0.29	6.7
OCONUS[b]	107	0.29	0.23	0.34	108	0.29	0.24	0.35	101	0.28	0.22	0.33	-2.8
Total	1,882	--	--	--	1,849	--	--	--	2,039	--	--	--	--

[a] First record per individual per year.
[b] OCONUS = Outside the continental United States.
[c] Rate percent change was calculated between the FY 2013 rate and the FY 2015 rate.
95% Confidence Intervals
Rate per 1,000 beneficiaries
Data Source: NMCPHC HL7 formatted CHCS chemistry and microbiology databases.
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center on 8 December 2016.

Table 7 presents the clinical characteristics for LRIs. Sputum was consistently the most frequently identified specimen source (75%). LRIs were generally evenly split between inpatient and outpatient settings each year.

Table 7. Total Lower Respiratory Infections by Select Clinical Characteristic among DOD Beneficiaries, FY 2013 – 2015

	Total	FY 2013	FY 2014	FY 2015
Specimen				
Bronchial	1,119	415	333	371
Pleural	133	38	52	43
Trachea	846	275	255	316
Sputum	6,767	2,044	2,212	2,511
Lower, NOS[a]	62	20	25	17
Patient Type				
Inpatient	4,248	1,402	1,317	1,529
Outpatient	4,679	1,390	1,560	1,729
Total	8,927	2,792	2,877	3,258

[a] NOS = Not otherwise specified
Data Source: NMCPHC HL7 formatted CHCS chemistry and microbiology databases.
Prepared by the EpiData Center Department, Navy and Marine Corps Public Health Center on 3 March 2016.

Discussion

This report presents frequencies and rates of bacterial URIs and LRIs within the MHS for all DOD beneficiaries from October 2012 through September 2015. Overall, of those tested the rates of URIs and LRIs increased by 38.6% and 15.2%, respectively, from FY 2013 to FY 2015. The cause of an increase in respiratory infections observed among the DOD population in this analysis is unknown. The increasing trend identified in this analysis for URIs and LRIs could be due to a change in clinical and testing practices or a change in disease burden. The increase seen may have been impacted by better data capture from the Defense Health Surveillance System (DHSS) implemented during the second quarter of 2014. Additionally, it is possible that the increase observed among URI and LRI cases during the surveillance period is related to the increase of influenza infections identified within the DOD in FY 2014, as well as the shift in timing of the influenza season observed in FY 2015.[19,20] Higher rates of influenza infections and infections identified later in the influenza season may result in more bacterial coinfections and secondary bacterial infections. Studies of viral respiratory infections have reported URIs and LRIs as complications of infection, thereby prolonging disease and contributing to more severe clinical symptoms.[5-8] However, previous studies for the general US population and prior analysis of URIs and LRIs within the DOD population from FY 2009 to FY 2012 do not agree with this report's current findings; both the general US and DOD populations identified a decrease in incidence of respiratory infections in recent years.[11,12] A study of US military recruits identified a significant decline in respiratory illness from 2011 – 2013, coinciding with the reintroduction of the adenovirus vaccines in late 2011 at recruit training sites.[18] Additionally,

the rise in incidence rates observed in the present analysis also does not align with a recent Armed Forces Health Surveillance Branch (AFHSB) study that showed a 14% decline in the number of ambulatory respiratory visits from 2011 to 2015 among active duty members.[3] The contrasting difference observed between declining occurrence of respiratory symptoms and encounters in the US military and the general US populations and the increasing respiratory infections observed in this study indicate that further studies and comparisons are needed to confirm that the increases seen in this analysis are in fact an increase in disease burden and not a reflection of increased or enhanced testing practices within the MHS.

URIs peaked in the winter and spring months, and decreased in the summer months. This coincides with findings from the Centers for Disease Control and Prevention (CDC)[11] in which respiratory infections tended to occur most often between the months of January and March. This seasonality may reflect the fact that populations spend more time indoors during the winter and are more often exposed to enclosed spaces (e.g., schools, barracks) and co-circulating infectious agents. Synergistic relationships can also occur between bacteria and viruses within a human host, leading to prolonged clinical symptoms and possibly the need to seek care which results in a confirmatory laboratory result.[8,11,21]

LRIs did not display the same seasonality trends seen among URIs in this analysis. The literature does not provide adequate insight into seasonal trends of LRIs; however, specific organism activity associated with LRIs may address the observations seen here. Some literature supports the existence of opposing season of peak activity with different organisms, particularly *P. aeruginosa* and *S. aureus*; these organisms were the most commonly identified in this analysis of LRIs. Perencerich *et al.* found a 28% higher rate of hospital-associated *P. aeruginosa* infection in summer months compared to winter months and no significant summer peaks for *S. aureus*. The study included all clinical specimens, but lower respiratory specimens accounted for 28% of *P. aeruginosa* and 25% of *S. aureus*.[22] Psoter *et al.* also demonstrated summer peaks for *P. aeruginosa* in cystic fibrosis patients.[23] The study also investigated *S. aureus* and noted the lack of seasonal variation in that population as well.

This report summarized recent trends in URIs and LRIs in the US DOD beneficiary population. Incidence of URIs and LRIs increased by more than 10% over the surveillance period. Findings underscore the importance to continue monitoring these infections, especially during periods of high respiratory illness activity due to the synergistic relationship between respiratory bacteria and co-circulating viruses that can lead to increased morbidity and mortality. In addition, the occupational exposure of DOD personnel, such as frequent deployments, relocations, and travel, increase the risk of respiratory illnesses. Limiting coinfections, promoting vaccinations, and enhancing antimicrobial stewardship could supplement risk reduction of bacterial respiratory illness. Periodic monitoring of bacterial respiratory infections may also contribute to risk reduction by identifying at-risk populations so that population-specific interventions may be established, thus allowing for the alleviation of increased morbidity and mortality.

Limitations

This study included several important limitations. First, HL7 formatted chemistry and microbiology data utilized in this report originated at fixed MTFs and do not include records from shipboard, battalion aid stations, or in theater facilities. This limitation predominately excludes from the study those active duty members seen and treated in a forward deployed clinic or aid station. The active duty component comprises approximately 15% of the beneficiary population. Because an even smaller proportion of active duty personnel are served solely by non-fixed MTFs and this report included all DOD beneficiaries seeking care within the MHS, the inability to include this subpopulation of active duty members likely does not significantly impact reported trends.

Chemistry and microbiology data are useful for identifying laboratory-confirmed cases of illness. However, cases in which a physician chooses to treat presumptively without laboratory confirmation are not captured in this analysis. Testing practices may also vary between healthcare providers and facilities. It is unclear how often presumptive treatment occurs in cases of bacterial respiratory infection. Presumptive treatment may lead to the underestimation of the true burden of respiratory bacterial infections.

This analysis included only the five most prevalent and clinically significant genera. *Streptococcus*, *Staphylococcus*, *Haemophilus*, *Klebsiella*, and *Pseudomonas* are clinically significant because they frequently cause bacterial URIs and LRIs and they were prevalent among the DOD beneficiary population. These organisms may be clinically significant among specific subpopulations within the DOD, and may be more prevalent among certain individuals with specific comorbidities and conditions and not necessarily prevalent among a healthier population including the active duty component.

Furthermore, classifying chemistry and microbiology tests involves extensive searching of free-text test result fields. The organisms in this report are typically part of normal respiratory flora. If a record identified an organism but did not identify the organism as normal flora, the record remained in the analysis. This report assumes clinicians performed cultures due to the clinical presentation, although it is possible that some of the test results were misclassified, despite validation steps taken to reduce error.

Rapid diagnostic *Streptococcus spp*. testing records vary by facility. Identification of rapid tests from throat specimens occurred, but some results did not specify Group A organisms and were therefore classified in the general *Streptococcus* species category. Positive tests remained in the analysis, although misclassification of the organism at the species level may have occurred. A subset of facilities performed rapid diagnostic *Streptococcus* tests, but consistently had nonspecific specimens identified within the records. Nonspecific specimens are records that indicate only swabs with no reference to a particular respiratory site. Analysis excluded these nonspecific records, which may result in underreporting for specific regions.

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Acronym/Abbreviation List

Acronym/Abbreviation	Definition
AFHSB	Armed Forces Health Surveillance Branch
CDC	Centers for Disease Control and Prevention
CHCS	Composite Health Care System
CI	Confidence Interval
DHSS	Defense Health Service System
DOD	Department of Defense
DON	Department of the Navy
EDC	EpiData Center Department
FY	Fiscal year
GAS	Group A *Streptococcus*
HL7	Health Level 7
LRI	Lower respiratory infection
MHS	Military Health System
M2	Military Health System Data Mart
MTF	Military Treatment Facility
NHRC	Naval Health Research Center
NMCPHC	Navy and Marine Corps Public Health Center
OCONUS	Outside of the continental United States
URI	Upper respiratory infection
US	United States